REMARKS

Applicant hereby responds to the office action of December 28, 2005, in the above-referenced patent application. Claims 1, 6-9 and 13-15 were pending in the patent application. New claims 16-17 have been added. No new matter has been added. Claims 1, 6-9 and 13-15 were rejected under 35 USC 103(a) as being unpatentable over Cheikh et al. ("Cheikh") [NPL document titled, "Directional-Rational Approach for Color Image Enhancement"]. Claim 2 was rejected under 35 USC 103(a) as being unpatentable over Cheikh in view of Lee et al. ("Lee") [NPL document titled, "Detecting Boundaries in a Vector Field"]. Claims 3, 4, 10 and 11 we objected as being dependent of rejected base claims, but deemed allowable if rewritten in independent form, including limitations of base claims and any intervening claims.

Claim 14 was rejected under 35 USC 112, first paragraph, due to the phrase "gain suppression function increases as probability of shoot increases" therein. Claim 14 has been amended to correct a typographical error and overcome the rejection.

The Examiner has interpreted the claims by interpreting "boundary of an edge" to mean a sharp edge (i.e., a pixel with maxima above or below threshold gradient). While Applicant appreciates the Examiner's efforts, it is respectfully requested that the Examiner use the clarification the Applicant provided, and not redefine that clarification. As such, the Examiner's

redefinition is unnecessary and is respectfully traversed as lacking. Applicant had previously succinctly and specifically clarified that according to the present invention boundary of an edge is one which satisfies two independent boundary-indicating conditions, such that e.g. a sample pixel *f(m, n)* is selected as being on boundary of an edge where at least one side of *f(m, n)* is a constant region, and the sample *f(m, n)* itself is not in a constant region (see example, pages 12-14 of the specification).

For example, on page 13, line 15 to page 14, line 8, of the specification, it is explained that the input sample *f(m,n)* is located at the boundary of an edge if *x(m,n)* is approaching 0 and *y(m,n)* is approaching 1 at the same time. The condition that *x(m,n)* approaches 0 implies that at least one of the backward or the forward first order sample difference is small, which means that at least one side is a constant region. Therefore, the condition that *x(m,n)* approaches 0 clearly excludes the case shown in FIG. 6, namely that the sample *f(m,n)* is in the middle of a spike signal. At the same time, the condition that *y(m,n)* approaches 1 implies that the sample f(m,n) is either located at the boundary of an edge or in the middle of a spike signal. Therefore, the condition that *y(m,n)* approaches 1 clearly excludes the case of a constant region. However, because *x(m,n)* is approaching 0, we have also excluded the case of a spike signal, and therefore, using the two criteria, we have a sufficient condition for concluding that the sample *f(m,n)* is located at the boundary of an edge.

As such, with respect to the step of "selecting edge pixel values representing a boundary of an edge in the first image", in claim 1, the selecting step is performed by evaluating two independent boundary-indicating functions and concluding that a given one of the pixel values of the image represents the boundary of the edge only if both of the two functions indicate that the given one of the pixel values is on the boundary.

Rejection of Claims 1, 6-9 and 13-15 under 35 USC 103(a) as being unpatentable over Cheikh is respectfully traversed for at least the following reasons. No prima facie case of obviousness has been established.

Regarding **Claim 1**, it is respectfully submitted that despite the Examiner's interpretation, Cheikh does not disclose the steps of: "obtaining a first image signal including pixel values; obtaining a high-pass image signal having high-frequency components of the first image signal", as required by Claim 1. In contending that Cheikh discloses such limitations, the Examiner relies on Examiner's annotation "5" on Fig. 2 of Cheikh as: "[5 on Figure 2]". However, 5 on Figure 2 in Cheikh show a directional high-pass operator which operates on output of 4 on Figure 2 in Cheikh which provides First Fundamental Form Decomposition of the input signal. As such, at best, 5 on Figure 2 in Cheikh provides a directional high-pass operation on First Fundamental Form Decomposition of the input image, but does not perform the steps of providing "a high-pass image signal having high-frequency components of the first image

signal," as required by Claim 1. Further, the directional high-pass operator/filter is applied at the direction of maximal rate of change, which does not disclose obtaining a high-pass image signal having high-frequency components of the first image signal. The directional high-pass operator/filter of Cheikh does not have the same input, does not function the same way, and does not provide the same output as the claimed steps of obtaining a high-pass image signal having high-frequency components of the first image signal.

Further, Cheikh does not disclose the steps of "selecting edge pixel values representing a boundary of an edge in the first image," as required by Claim 1. In rejecting Claim 1, the Examiner has picked a definition for an edge out of Cheikh (Page III-564, column 2, Paragraph 1 and Equation 8) and then improperly re-defined boundary of an edge in the present invention to match the exact definition in Cheikh. By re-defining (mis-interpreting) the claimed boundary of an edge, to be the same as the definition of edge in Cheikh, the Examiner has read meaning into the claimed limitations which is lacking. Further, the Examiner interprets the claims boundary of an edge as sharp edge in Cheikh. This is respectfully traversed. The Examiner has not met the burden of proof by showing that Cheikh discloses that a sharp edge is the same as the claimed boundary of an edge which satisfies two independent boundary-indicating conditions, such that e.g. a sample pixel $f(m, n)$ is selected as being on boundary of an edge where at least one side of $f(m, n)$ is a constant region, and the sample $f(m, n)$ itself is not in a constant region (as detailed further above). Indeed, equation (8) of Cheikh defines behavior of the control function f, as

$\Delta \rightarrow \infty$ to avoid excessive overshoot over sharp edges. How does that disclose selecting edge pixel values representing a boundary of an edge, as claimed?

In fact, Cheikh's definition of a sharp edge teaches away from the claimed selecting edge pixel values representing a boundary of an edge as it is not evaluating independent boundary-indicating conditions. Cheikh suffers from false application of the control function to edges since it does not utilize selecting edge pixel values representing a boundary of an edge, as claimed.

'How does Cheikh disclose selecting pixels representing boundary of an edge? How does $\Delta \rightarrow \infty$ in Cheikh disclose selecting pixels representing boundary of an edge, as in the present invention? $\Delta \rightarrow \infty$ could be due to threshold $D \rightarrow 0$, or magnitude of mutlivalued gradient $g \rightarrow \infty$, etc. What does that have to do with selecting edge pixel values representing a boundary of an edge in the first image, as claimed? The Examiner has not met the burden of proof.

Further, Page III-564, column 2, Paragraph 1 and Equation 8 in Cheikh is directed to operation of function f [7 on Figure 2] on the output of 4 on Figure 2 in Cheikh which provides First Fundamental Form Decomposition of the input signal, and not the first image including pixels, as claimed. Why has the Examiner ignored operation of 4 on Figure 2 of Cheikh on the input signal which provides a different input to 5 and 7 in Figure 2 of Cheikh, than the original

input image signal? If the claims are once again rejected, Applicant respectfully requests an explanation for this. If operation of 4 on Figure 2 is removed, the system of Cheikh will not operate as intended and collapses (Cheikh's system requires determining direction of change θ, and rate of change λ, output from 4 on Figure 2).

Further, Cheikh does not disclose the steps of "for suppressing shoots, defining a gain suppressing function having attenuation coefficients to be multiplied with particular pixel values of the high-pass image signal corresponding in location to the edge pixel values," as claimed. The control function *f* (equation 8, 9) in Cheikh is a non-linear control function that depends in its operation on the rate of change λ from 4 on Figure 2 of Cheikh. It is different from a gain suppressing function having attenuation coefficients to be multiplied with particular pixel values of the high-pass image signal corresponding in location to the edge pixel values, as claimed. The function *f* in Cheikh is directed to providing control based on rate of change λ, rather than attenuation coefficients relating to selected edge pixel values representing a boundary of an edge, as claimed.

Accordingly, for at least the above reasons, Cheikh does not disclose "multiplying the high-pass image signal by the weighting factor and by the gain suppressing function to obtain a result," as claimed. Cheikh does not even disclose the steps of "obtaining a positive non-zero weighting factor to control a degree of enhancement," as required by Claim 1.

Further, Cheikh does not disclose "adding the result to the first image signal to obtain an enhanced image signal in which the shoots have been suppressed," as claimed. In Cheikh, 2 on Figure 2, the signal I' (that is being added to the input signal I), is different from the result signal that is being added to the first image signal, for at least the reasons provided above.

Further, as the Examiner also states, Cheikh does not disclose the steps of: obtaining a positive non-zero weighting factor to control a degree of enhancement, and multiplying the high-pass image signal by the weighting factor and by the gain suppressing function to obtain a result, as required by Claim 1. However, the Examiner relies on Figure 1of Cheikh for the contention that Cheikh discloses such limitations. This is respectfully traversed. First, 6 in Figure 1 of Cheikh is not a positive non-zero weighting factor to control a degree of enhancement, a claimed. Further, even if as the Examiner contends 6 in Figure 1 of Cheikh is a weighting factor as claimed (which Applicant traverse), Cheikh criticizes Figure 1 and use of 6 in Figure 1 as having several drawbacks (III-563, col. 2, first paragraph under Figure 1). Cheikh teaches away from obtaining a positive non-zero weighting factor to control a degree of enhancement, and multiplying the high-pass image signal by the weighting factor, as required by Claim 1.

It is well settled that in order for a modification or combination of the prior art to be valid, the prior art itself must suggest the modification or combination, "...invention cannot be found obvious unless there was some **explicit** teaching or suggestion in the art to motivate one of

ordinary skill to combine elements so as to create the same invention." *Winner International Royalty Corp. v. Wang*, No. 96-2107, 48 USPQ.2d 1139, 1140 (D.C.D.C. 1998) (emphasis added). "The prior art **must provide** one of ordinary skill in the art the **motivation** to make the proposed molecular modifications needed to arrive at the claimed compound." *In re Jones*, 958 F.2d 347, 21 USPQ.2d 1941, 1944 (Fed. Cir. 1992) (emphasis added). There is no motivation or suggestion in Cheikh for combination/modification as suggested by the Examiner, and the Examiner has not provided reference to such in Cheikh.

The Examiner attempts to modify Cheikh in order to teach Applicant's claimed invention by improperly using "hindsight" and the teachings of Applicant's own claimed invention in order to combine references to render Applicant's claims obvious. The Examiner contends that it is obvious to modify Cheikh Figure 2 as in Figure 1. However, Cheikh teaches away from the claimed limitations, and the suggested modification by the Examiner. One of ordinary skill in the art will not look to Cheikh to come up with the claimed limitations.

Further, even if according to the Examiner, Cheikh indeed discloses such a weighting factor limitation (which Applicant traverse), Cheikh does not disclose combination of such limitation with a gain suppressing function having attenuation coefficients. Further, Cheikh does not suggest or motivate: obtaining a positive non-zero weighting factor to control a degree of enhancement; multiplying the high-pass image signal by the weighting factor and by the gain

suppressing function to obtain a result; and adding the result to the first image signal to obtain an enhanced image signal in which the shoots have been suppressed, as required by Claim 1. No prima facie case of obviousness has been established. For at least these reasons, rejection of Claim 1 and all claims dependent therefrom, should be withdrawn.

Regarding **Claim 6**, Cheikh III-564, col. 1, Para. 1, I (u1, u2) does not disclose that "the edge extends in a horizontal direction," as required by Claim 6. Cheikh describes I (u1, u2) as a multivalued image with components xi(u1, u2). There is no disclosure of an edge or an edge that extends in the horizontal direction, in that passage or elsewhere in Cheikh. Further, the Examiner does not explain how u1 has anything to do with an edge or a horizontal edge. For at least these reasons, rejection of Claim 6 should be withdrawn.

Regarding **Claim 7**, Cheikh III-564, col. 1, Para. 1, I (u1, u2) does not disclose that "the edge extends in a vertical direction," as required by Claim 6. Cheikh describes I (u1, u2) as a multivalued image with components xi(u1, u2). There is no disclosure of an edge or an edge that extends in the vertical direction, in that passage or elsewhere in Cheikh. Further, the Examiner does not explain how u2 has anything to do with an edge or a horizontal edge. For at least these reasons, rejection of Claim 7 should be withdrawn.

Regarding **Claim 8**, for at least the reasons provided in relation to Claim 1, Cheikh does not disclose the steps of obtaining the high-pass image signal or doing so by filtering the first image signal, as required by Claim 8. For at least these reasons, rejection of Claim 8 should be withdrawn.

Regarding **Claim 9**, for at least the reasons provided in relation to Claim 1, Cheikh does not disclose that the gain suppressing function inherently performs the step of selecting the edge pixel values, as required by Claim 9. For at least these reasons, rejection of Claim 9 should be withdrawn.

Regarding **Claim 13,** as discussed above Cheikh does not disclose all of the limitations of base claim 1. Further, Cheikh does not disclose "defining the gain suppressing function having attenuation coefficients to be multiplied with particular pixel values of the high-pass image signal corresponding in location to the edge pixel values, wherein the gain suppressing function is based on the probability of shoot at the edge pixel values," as required by Claim 13. Cheikh, III-564, col. 2, Para. 3, Item iii (relied on by the Examiner), simply describes function *f*, or that $\Delta \rightarrow \infty$ in any way represents the gain suppressing function is based on the probability of shoot at the edge pixel values. The Examiner has not met the burden of proof in showing that Cheikh discloses a gain suppressing function that is based on the probability of shoot at the edge pixel values, as claimed. Indeed, Cheikh does not disclose selecting pixels representing boundary of

an edge, as in the present invention. $\Delta \rightarrow \infty$ could be due to threshold $D \rightarrow 0$, or magnitude of mutlivalued gradient $g \rightarrow \infty$, etc., and does not disclose a gain suppressing function that is based on the probability of shoot at the edge pixel values.

Further, Page III-564, column 2, Equation 8 in Cheikh is directed to operation of function f [7 on Figure 2] on the output of 4 on Figure 2 in Cheikh which provides First Fundamental Form Decomposition of the input signal, and not the first image including pixels, as claimed. The function f in Cheikh is directed to providing control based on rate of change λ, rather than attenuation coefficients relating to selected edge pixel values representing a boundary of an edge and depending on the probability of shoot at the edge pixel values, as claimed. For at least these reasons, rejection of Claim 13 should be withdrawn.

Regarding **Claim 14,** as discussed above Cheikh does not disclose all of the limitations of base claim 1. Further, Cheikh does not disclose defining the gain suppressing function having attenuation coefficients to be multiplied with particular pixel values of the high-pass image signal corresponding in location to the edge pixel values, wherein the gain suppressing function is based on the probability of shoot at the edge pixel values such that the gain suppression function decreases as probability of shoot increases to reduce shoot, as claimed. Cheikh, III-564, col. 2, equations 8-9 (relied on by the Examiner), simply describe control function f when $\Delta \rightarrow \infty$, and does not in any way represent the gain suppressing function is based on the probability of

shoot at the edge pixel values. Nor does it in any way disclose that the gain suppression function decreases as probability of shoot increases to reduce shoot, as claimed. The Examiner has not met the burden of proof in showing that Cheikh discloses a gain suppressing function that is based on the probability of shoot at the edge pixel values, as claimed. The function f in Cheikh is directed to providing control based on rate of change λ, rather than attenuation coefficients relating to selected edge pixel values representing a boundary of an edge and depending on the probability of shoot at the edge pixel values, as claimed. For at least these reasons, rejection of Claim 14 should be withdrawn.

Regarding **Claim 15** as discussed above Cheikh does not disclose all of the limitations of base claim 1. Further, Cheikh does not disclose that boundary of an edge is defined by independent boundary-indicating conditions. Cheikh, III-564, col. 2, equations 8-9 (relied on by the Examiner), simply describe control function f when $\Delta \rightarrow \infty$. This has nothing to do with independent conditions that define boundary of an edge. The Examiner has not met the burden of proof in showing what the independent boundary-indicating conditions in Cheikh are. For at least these reasons, rejection of Claim 15 should be withdrawn.

Rejection of **Claim 2** under 35 USC 103(a) as being unpatentable over Cheikh in view of Lee is respectfully traversed because, the references alone or in combination, do not disclose all of the claimed limitations. As discussed above Cheikh does not disclose all of the limitations of

base claim 1. Further, as the Examiner also states, Cheikh does not disclose evaluating two independent boundary-indicating functions and concluding that a given one of the pixel values of the first image represents the boundary of the edge only if both of the two functions indicate that the given one of the pixel values is on the boundary, as claimed.

However, the Examiner contends that Lee discloses such limitations, and then modifies Cheikh with Lee to teach the claimed limitations. This is respectfully traversed because the references, alone or in combination, do not disclose the claimed limitations. By contrast, to the present invention, Lee (page 1183, col. 1, section IV, item 5) does not evaluate independent boundary-indicating functions. Lee mentions the candidate boundary points that have gradient amplitudes greater than a low threshold T_l, and are connected to at least one point that has a gradient amplitude greater then a high threshold T_h, are marked as boundary points. However, Lee does not disclose independent boundary-indicating functions, rather Lee mentions two thresholds T_l, T_h, that are not independent as claimed herein. In Lee it is all about the same function (i.e., gradient amplitude value) and not independent boundary indicating functions, as claimed.

Further, it is well settled that in order for a modification or combination of the prior art to be valid, the prior art itself must suggest the modification or combination, "...invention cannot be found obvious unless there was some **explicit** teaching or suggestion in the art to motivate one

of ordinary skill to combine elements so as to create the same invention." *Winner International Royalty Corp. v. Wang*, No. 96-2107, 48 USPQ.2d 1139, 1140 (D.C.D.C. 1998) (emphasis added). "The prior art **must provide** one of ordinary skill in the art the **motivation** to make the proposed molecular modifications needed to arrive at the claimed compound." *In re Jones*, 958 F.2d 347, 21 USPQ.2d 1941, 1944 (Fed. Cir. 1992) (emphasis added). There is no motivation or suggestion in Cheikh for combination/modification as suggested by the Examiner, and the Examiner has not provided reference to such in the references.

Further, why would one of ordinary skill in the art modify Cheikh to introduce thresholding by Lee? The Examiner has already contended that Cheikh provides boundary detection, and now the Examiner has decided to modify Cheikh's boundary detection with Lee's thresholding? What is the motivation of providing thresholding in Cheikh? How would thresholding even work in Cheikh? It is respectfully submitted that Cheikh cannot be modified to support thresholding as a functional system.

The Examiner attempts to modify Cheikh in order to teach Applicant's claimed invention by improperly using "hindsight" and the teachings of Applicant's own claimed invention in order to combine references to render Applicant's claims obvious. Indeed, Cheikh provides its own thresholding (III-564, col. 2, items i , ii) that teaches away from thresholding such as in Lee. One of ordinary skill in the art will not look to Cheikh to come up with the claimed limitations. For at

least these reasons, rejection of Claim 2 should be withdrawn.

New Claims

New Claims 16-17 includes all of the limitations of Claims 1-2, and further add the limitations of the nature of independent boundary indicating functions. Such limitations are supported by the originally filed specification, and not disclosed by the references alone or in combination.

CONCLUSION

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For these, and other, reasons, Applicants believe that the claims are in condition for allowance. Reconsideration, re-examination, and allowance of all claims are respectfully requested.

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on March 28, 2006.

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Respectfully submitted,

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